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Title: Reflection processing of the large-N seismic data from the Source Physics Experiment (SPE)

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Reflection processing of the large-N seismic data from the Source Physics Experiment (SPE)

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Advisors: Dr. Ting Chen and Dr. Cathy Snelson

Los Alamos National Laboratory

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LANL: Brief History

- Established in 1943 for the purpose of designing the building the atomic bomb (Manhattan Project)
- Oppenheimer and Groves in charge
- Trinity: first detonation of nuclear bomb, July 16, 1945
- Little Boy (uranium): Hiroshima, August 6, 1945
- Fat Man (plutonium): Nagasaki, August 9, 1945



Information and photograph from: <http://www.lanl.gov/about/history-innovation/index.php>

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LANL Today

<http://serviceinternships.com/internship-experience-los-alamos-national-lab/>

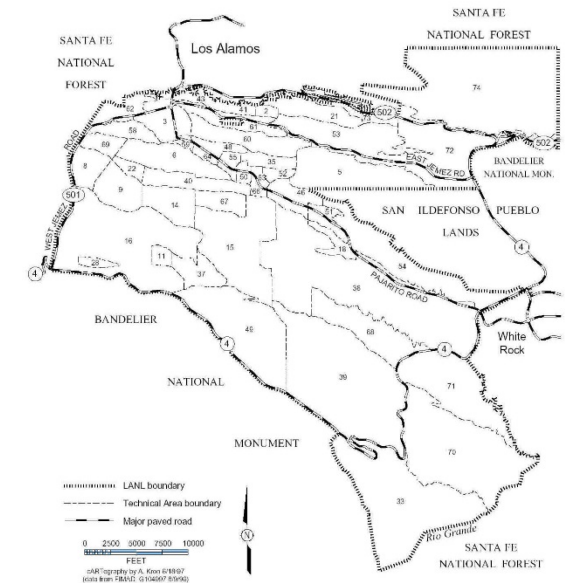


Figure 2-1. Active technical areas at Los Alamos National Laboratory.

<http://cryptome.org/eyeball/lanl/lanl-eyeball.htm>

<http://www.lanl.gov/discover/news-release-archive/2015/August/08.25-ey-lanl-new-cybersecurity-tools.php>

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SPE Purpose

- Develop a more physics-based model for nuclear explosion identification
- Understand the development of S-waves from explosion sources
- Enhance nuclear test ban treaty monitoring

Snelson, C. M., R. E. Abbott, S. T. Broome, R. J. Mellors, H. J. Patton, A. J. Sussman, M. J. Townsend and W. R. Walter (2013), Chemical Explosion Experiments to Improve Nuclear Test Monitoring, *Eos Trans. AGU*, 94(27), 237.



<http://www.pnnd.org/article/parliamentarians-and-north-korean-nuclear-test>

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SPE & Large-N Seismic Deployment

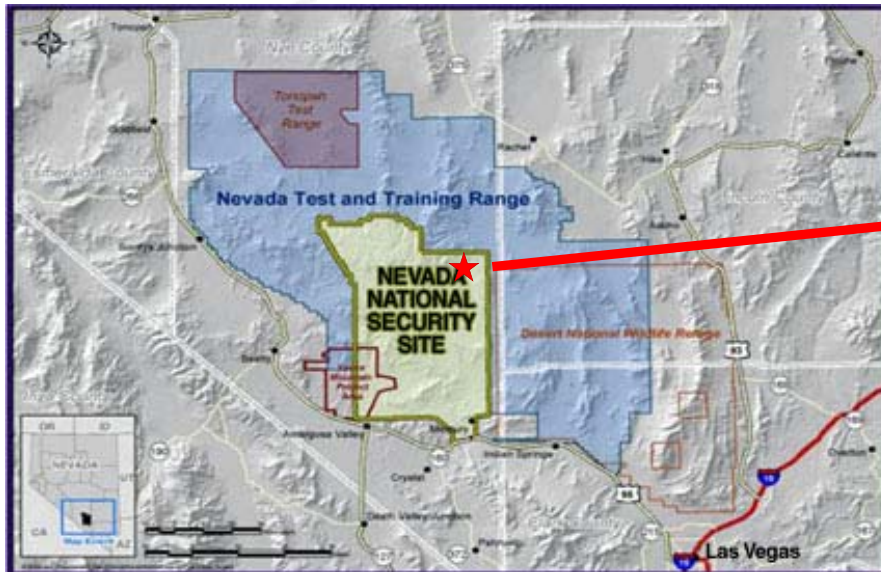
- Multi-institutional, interdisciplinary project, DOE funded
- Series of chemical explosions at NNSS (Nevada National Security Site)
- Purpose: understand the development of S-waves from explosive sources
- Purpose of Large-N: improve the geologic model of the SPE location as well as ground-truth propagation of S-waves



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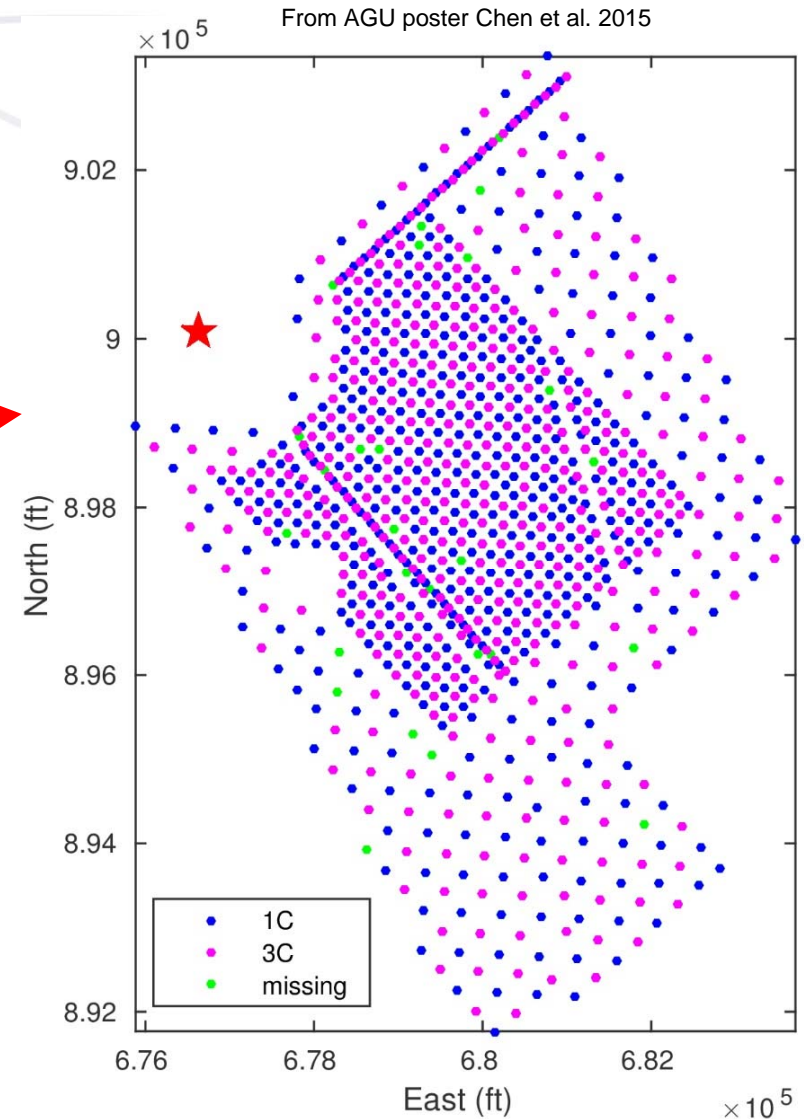
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Large-N Layout



<http://www2.nstec.com/pages/NNSS-Mission.aspx>

- Large array of 1C and 3C geophones (large-N) 500 of each
- Recorded seismic activity for a month

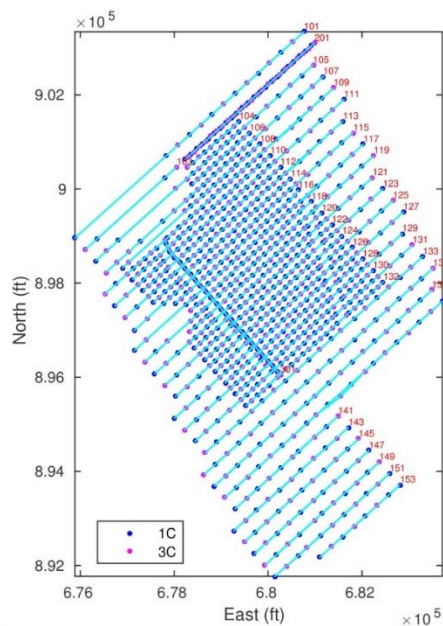


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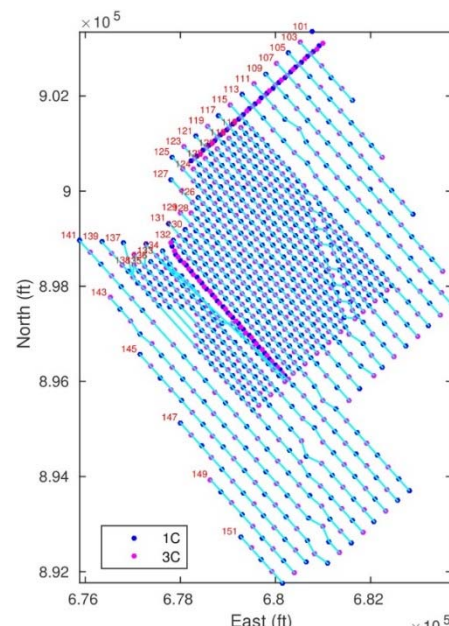
Preliminary Research Tasks

- Check segy trace headers for errors
- Check moveout along the same line/station number

Line Numbers

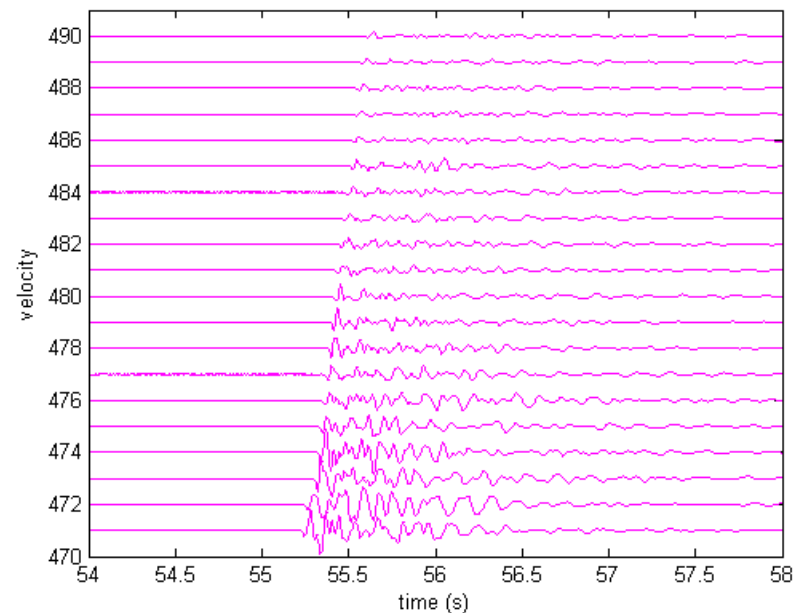


Station Numbers



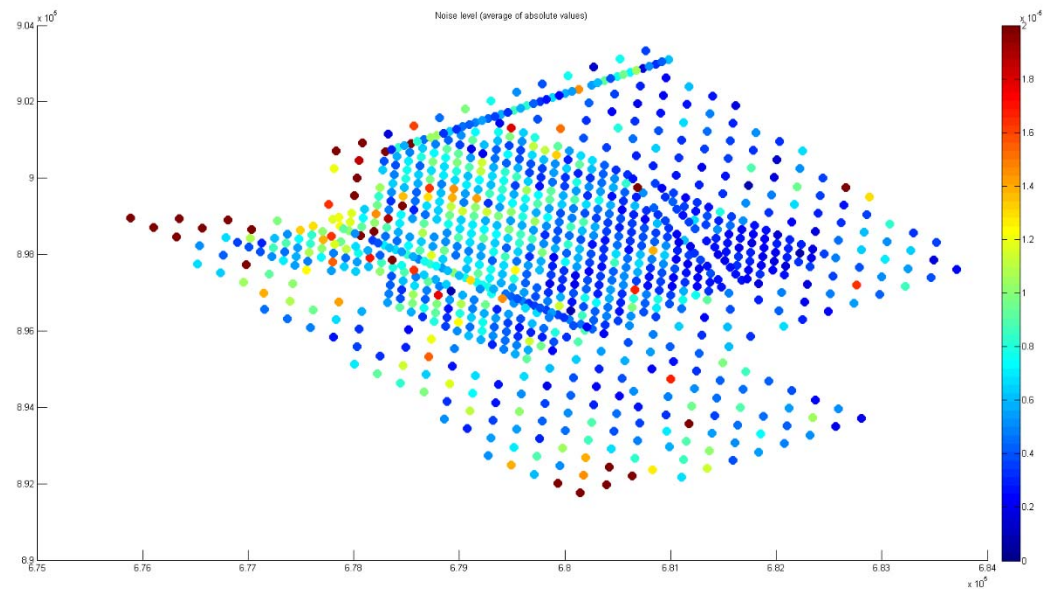
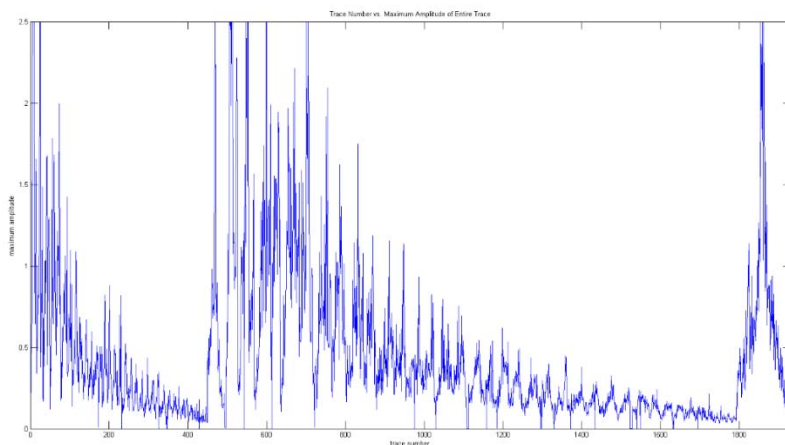
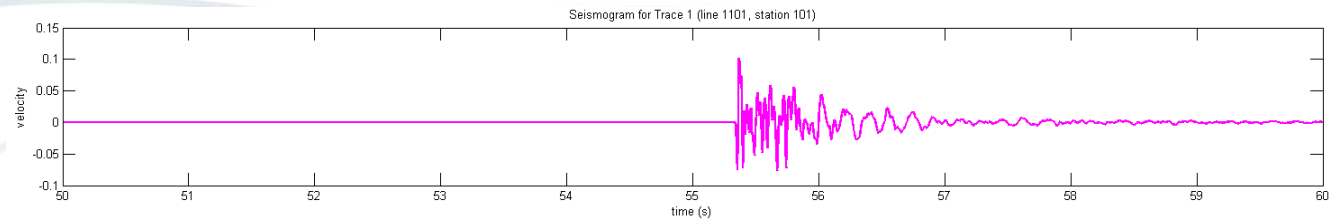
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Moveout for line 301 (South dense line)



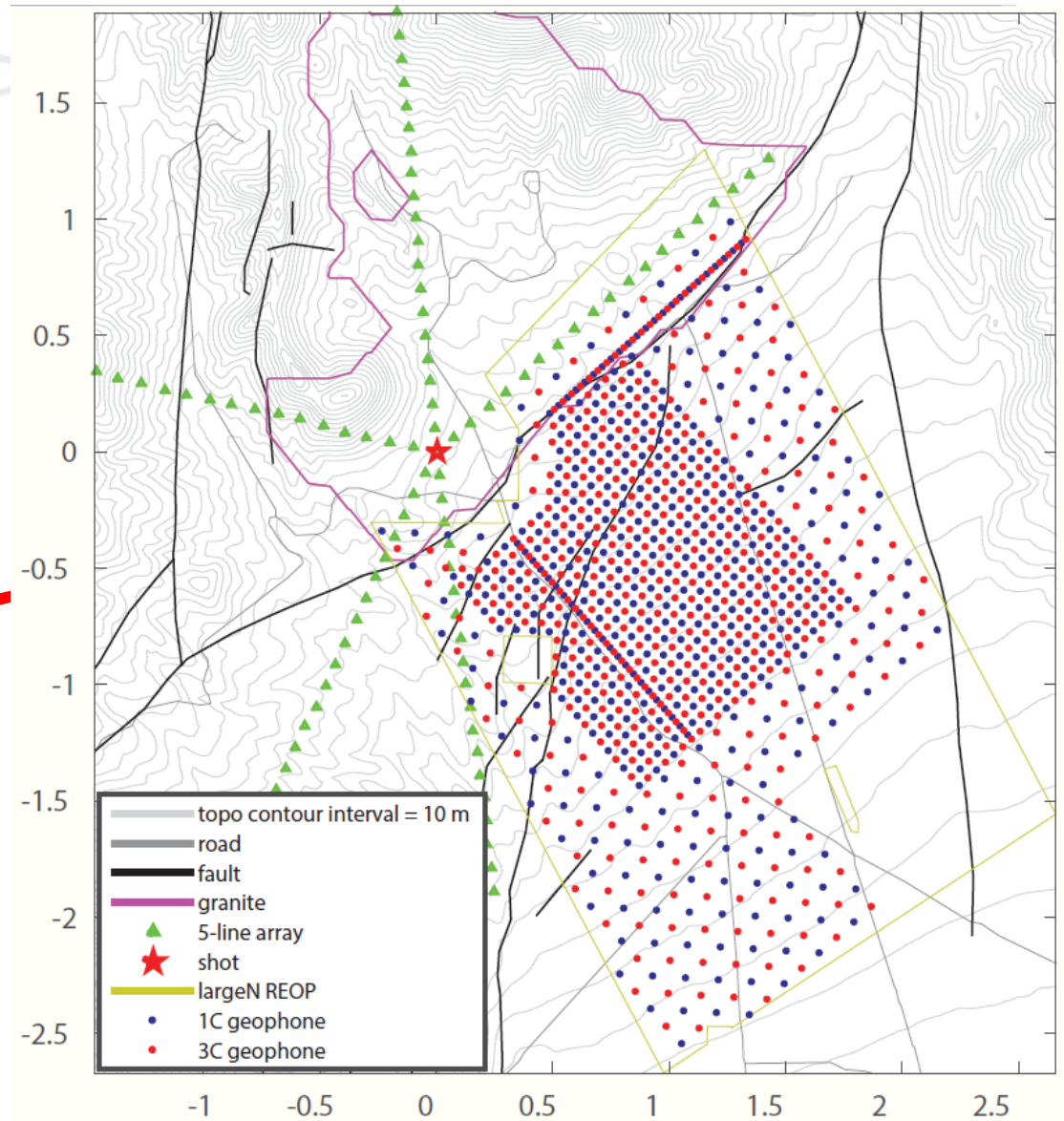
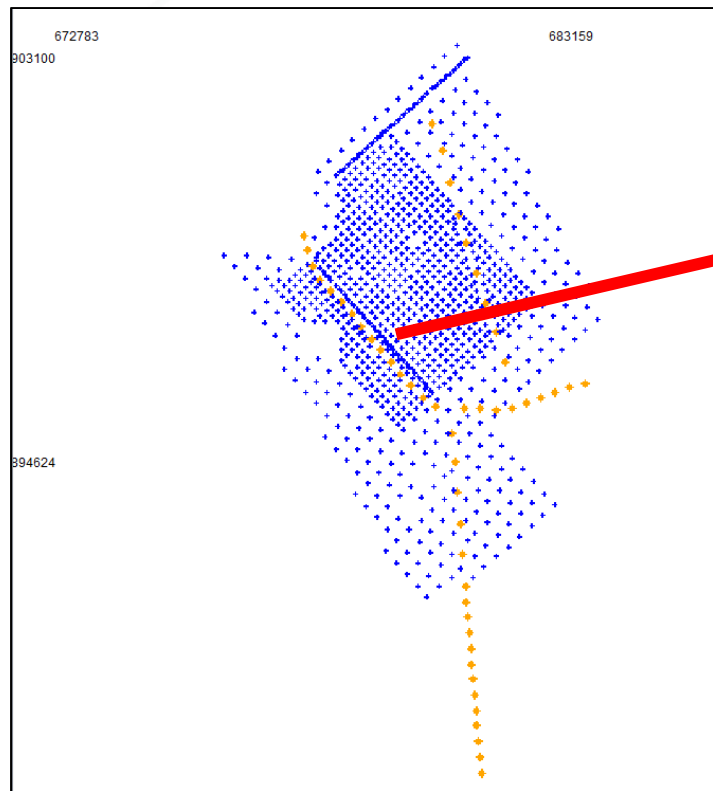
Noise

- Plot the noise of each trace (2 methods)
 - Maximum amplitude
 - Average of the absolute values of trace data



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South Dense Line



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Reflection Model

- Using SPW (Seismic Processing Workshop)
- Butterworth filtering
- Spherical divergence
- Surface consistent decomposition and deconvolution
- Automatic gain control
- Constant velocity stacking
- Residual statics corrections (might/might not be necessary)

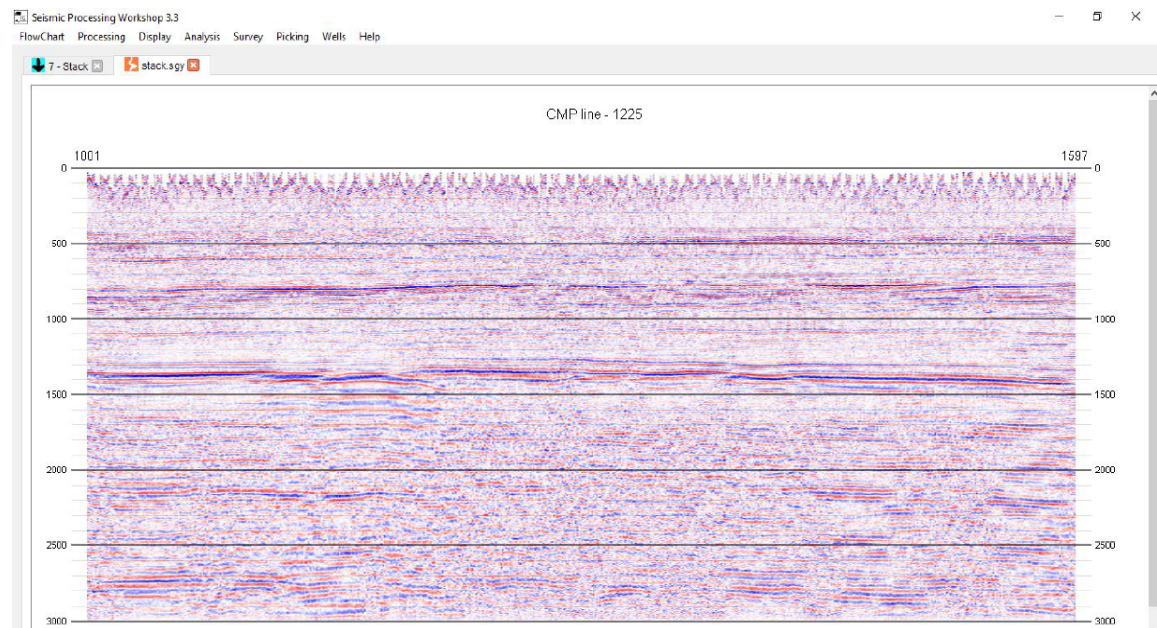
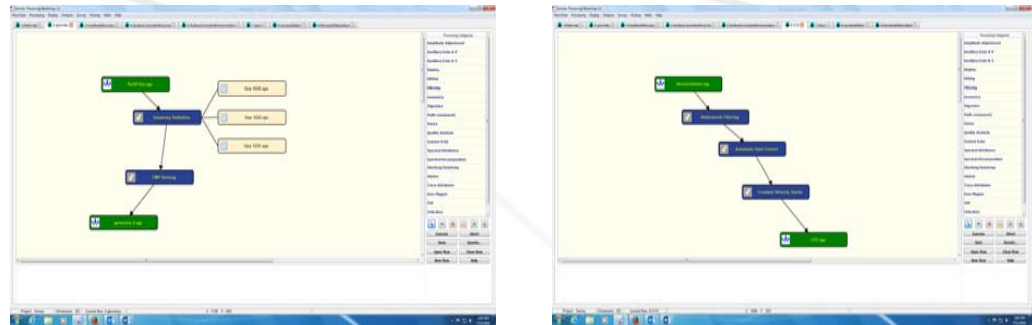


Image from SPW tutorial by Matthew Ralston

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